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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER				
SNOW, COLLEEN ERIN				
ART UNIT		PAPER NUMBER		
2813				
NOTIFICATION DATE		DELIVERY MODE		
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

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# Office Action Summary

**Application No.**

10/519,406

**Applicant(s)**

DI CIOCCIO ET AL.

**Examiner**

Colleen E. Snow

**Art Unit**

2813

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 September 2010.  
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 10-13 and 18-21 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.  
6) ☒ Claim(s) 10-13 and 18-21 is/are rejected.  
7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)  
3) ☒ Information Disclosure Statement(s) (PTO/SB-08)  
Paper No(s)/Mail Date 06/07/2010  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_  
5) ☐ Notice of Informal Patent Application  
6) ☐ Other: \_\_\_\_\_

### DETAILED ACTION

1. This Office Action responds to the Amendment filed 9 September 2010. By this amendment, claims 19-21 are newly added. Claims 10-13 and 18-21 are pending.

#### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 10-12 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Goesele et al** (USPN 6,150,239) in view of **Sakaguchi et al** (US Patent Application Publication 2003/0170990).

Regarding claim 18, **Goesele et al** disclose a method for transferring an electrically active SiC thin layer from an initial SiC substrate, the method comprising:

performing hydrogen ion implantation through a face of the initial SiC substrate and creating a buried, embrittled film [see col. 4, lines 24-29 and 56-59; see also col. 6, lines 29-33];

fastening the face of the initial SiC substrate after implantation to a face of a target substrate, to obtain a structure [see col. 5, lines 15-25]; and

separating the structure in two parts at a level of the buried embrittled film [see col. 5, lines 15-25].

**Goesele et al** do not specifically disclose the process of determining hydrogen ion implantation conditions including dose, energy and implantation current that create the buried,

embrittled film at a depth, with respect to an implanted face of the initial SiC substrate, wherein an implantation defect concentration in a first 500 nm of implanted SiC is lower than  $9 \times 10^{20}$  atoms/cm<sup>3</sup>, and a number of acceptor defects compatible with desired electrical properties of an active thin layer is obtained, nor do **Goesele et al** disclose thinning a layer of the SiC remaining fastened to the target substrate to a thickness lower of 500 nm.

**Goesele et al** do disclose, exemplarily, that the thin film layer is formed to a thickness of 0.58  $\mu\text{m}$  (580 nm), and the hydrogen concentration at the maximum (i.e. at a depth of 580 nm) is approximately  $6 \times 10^{21}$  atoms/cm<sup>3</sup> [see col. 10, lines 22-29], but do not disclose the concentration at a depth of 500 nm. However, it is known in the art that it is desirable to minimize the implantation defect concentration in implanted semiconductor thin films; defects and deformations in an active layer due to the implantation of atoms may cause quality issues and may be difficult to repair with a healing anneal. Therefore, the process of optimizing to determine the optimal implantation dose, energy and current in order to minimize the implantation defect concentration and the number of acceptor defects compatible with the desired electrical properties of the active layer is within reasonable and routine optimization processes performed by one of ordinary skill in the art. Generally, differences in process parameters will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. “Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” See *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Furthermore, **Sakaguchi et al** disclose a method of forming a thin film **22** on a target substrate **26** by delamination of a layer **22** from an initial substrate **21** [see Figs. 7-11]. Furthermore, **Usenko** discloses thinning the layer **22** [see paragraphs 0245-0251]. It would have been obvious to

one of ordinary skill in the art at the time of invention to thin the layer in order to provide a uniform thin active layer on the target substrate [see paragraph 0251].

Regarding claim 10, the prior art of **Goesele et al** and **Sakaguchi et al** disclose the method according to claim 18. Furthermore, **Goesele et al** disclose wherein the fastening includes direct wafer bonding, which comprises molecular adhesion [see col. 5, lines 12-14].

Regarding claim 11, the prior art of **Goesele et al** and **Sakaguchi et al** disclose the method according to claim 18. Furthermore, **Goesele et al** disclose a step of healing annealing of the implantation defects on the thin film [see col. 5, lines 15-17].

Regarding claim 12, the prior art of **Goesele et al** and **Sakaguchi et al** disclose the method according to claim 18. Furthermore, **Goesele et al** disclose wherein the healing annealing is carried out before the separating the thin film from a remainder of the initial substrate, which is carried out before the thinning step of **Sakaguchi et al** [see **Goesele et al**, col. 5, lines 15-25; see also **Sakaguchi et al**, paragraph 0251].

4. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Goesele et al** (USPN 6,150,239) in view of **Sakaguchi et al** (US Patent Application Publication 2003/0170990) as applied to claims 10-12 and 18 above, and further in view of **Maleville et al** (USPN 6,403,450).

Regarding claim 13, the prior art of **Goesele et al** and **Sakaguchi et al** disclose the method according to claim 11. Neither **Goesele et al** nor **Sakaguchi et al** disclose wherein the healing annealing is carried out after the thinning. **Maleville et al** disclose a method of thinning a semiconductor layer by formation of a sacrificial oxide, followed by a healing annealing step [see col. 7, lines 23-30]. It would have been obvious to one of ordinary skill in the art at the time of invention to include a healing annealing step after the thinning process because **Maleville et al**

teach that it heals the defects generated by the formation of the surface oxide layer and stabilizes the bonding interface [see col. 7, lines 23-30].

5. Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Goesele et al** (USPN 6,150,239) in view of **Sakaguchi et al** (US Patent Application Publication 2003/0170990) as applied to claims 10-12 and 18 above, and further in view of **Mitani et al** (USPN 7,084,046).

Regarding claim 19, the prior art of **Goesele et al** and **Sakaguchi et al** disclose the method according to claim 18. Neither **Goesele et al** nor **Sakaguchi et al** disclose wherein the performing hydrogen ion implantation creates said buried embrittled film at an average implantation depth greater than 1100 nm. **Mitani et al** disclose a substantially similar method of implanting hydrogen ions into a substrate wherein the implantation is carried out to a depth within a range from 100 to 2,000 nm deep from the surface of the wafer, and furthermore wherein the depth of ion implantation is adjustable by ion energy, specifically acceleration voltage [see col. 11, lines 23-49]. It would have been obvious to one of ordinary skill in the art at the time of invention to adjust the acceleration voltage of the hydrogen ion implantation in order to adjust the depth to which the ions are implanted in order to ensure that the thickness of the removed layer is sufficient for the intended purpose and not so thick that the energy expenditures in ion implanting to an extreme depth and in back-grinding the film after delamination are not cost prohibitive.

Regarding claim 20, the prior art of **Goesele et al**, **Sakaguchi et al** and **Mitani et al** disclose the method according to claim 19. While none of **Goesele et al**, **Sakaguchi et al** and **Mitani et al** disclose specifically wherein the thinning includes thinning the SiC remaining fastened to the target substrate with a thickness greater than 1100 nm to a thickness lower than 500 nm, the combined art would meet this limitation. **Goesele et al** in view of **Sakaguchi et al** suggest a depth

of less than 580 nm after delamination and thinning; in further combination with **Mitani et al**, it would have been obvious to one of ordinary skill in the art to control the ion implantation and thinning depths in order to provide a thin film to the required specifications.

Regarding claim 21, the prior art of **Goesele et al**, **Sakaguchi et al** and **Mitani et al** disclose the method according to claim 20. While none of **Goesele et al**, **Sakaguchi et al** and **Mitani et al** disclose specifically wherein the performing hydrogen ion implantation includes using an implantation energy of 180 keV, **Mitani et al** disclose that it would have been obvious to adjust the ion implantation energy in accordance with the desired depth of implantation [see col. 11, lines 44-49]. Furthermore, these claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious).

### ***Response to Arguments***

6. Applicant's arguments filed 9 September 2010 have been fully considered but they are not persuasive. On pages 5-6 of the Remarks, Applicants allege that **Goesele et al** do not disclose forming the buried, embrittled film to a depth deeper than the intended depth of the layer to be delaminated from the wafer. The Examiner agrees that **Goesele et al**, taken alone, do not disclose this feature. However, the independent claim does not require that the ion implantation be

performed at a depth deeper than the intended depth of the separation from the structure; rather, the instant claim requires that the ion implantation creates a buried, embrittled film at a depth, at which depth the separation occurs. Therefore, the Examiner submits that this argument, with respect to the independent claim, is moot.

Furthermore, on pages 6-7 of the Remarks, Applicants allege that **Sakaguchi et al** and **Maleville et al** do not cure the supposed deficiencies of **Goesele et al**, and that the references taken together do not arrive at the claimed invention. For the reasons described above, the Examiner submits that the disclosure of **Goesele et al**, in combination with the other applied art, renders the instant claims unpatentable. Therefore, the rejections stand.

### ***Conclusion***

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.



Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen E. Snow whose telephone number is (571)272-8603. The examiner can normally be reached on Monday through Friday, 8:00 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Landau can be reached on (571) 272-1731. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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